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Role of thick-skinned tectonics on thin-skinned salt tectonics in the western Mediterranean : a comparison between the Algerian and North-Balearic basins

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The Plio-Quaternary tectonics in the Western Mediterranean is dominated by gravity gliding and spreading above thick Messinian evaporites, characterized by proximal extension, mid-slope translation, and distal shortening. The distal region comprises circular or elongate diapirs whose rise was driven by combined shortening and sediment loading, rather than density inversion. Our study aims at to precisely identifying the salt-related structures and determining their geometry, their distribution and the associated structural features in the overburden, in order to better understand the interaction between sedimentation, salt tectonics, structural pattern and neotectonics. We use SIMRAD EM300 multibeam bathymetric data and 6-channel seismic profiles of two recent surveys (2003), respectively the PROGRES cruise over the deep-water North-Balearic Basin, including in and westward of the Rhône deep-sea fan, and the MARADJA cruise on the margin and in deep basin offshore Algeria to investigate the relationships between thick-skinned, crustal tectonics and gravity-driven thin-skinned salt tectonics. The morphology of the top of the mobile salt results from a combination of at least three main parameters: 1. For both areas, the regional depth distribution and the upslope boundary reflect the initial morpho-structure of the basin (i.e., variations in shape and orientation of the margin) and the basin's late evolution (i.e., the effects of the Messinian salinity crisis and the subsidence of the sediments). 2. The local perturbations result from salt tectonics and especially the numerous diapirs in the deepest parts, i.e., in front of the Rhone deep sea fan and in the western part of the Algerian

area. The 3-D geometry (orientation and location) of the salt anticlines, diapirs and ridges and associated depocenters (minibasins) is due mainly to differential sedimentary loading during gravity spreading and gliding of the brittle-ductile series. The 3-D network of salt ridges, observed in both areas suggests that salt-related thin-skinned contraction was multi-directional. 3. The role of thick-skinned tectonics depends on the local geodynamic setting. In the North-Balearic basin, reentrants of the upslope diapir boundary are unmistakably aligned above the Catalan and North-Balearic transfer zones (corresponding to basement steps). This geometry attests that the subsalt basement exerts significant "passive" structural control on salt tectonics. Conversely, in some places along the Algerian margin, located on the inner Europe-Africa convergent plate boundary, salt is more passively involved in the play of active ramps and flats, and depicts an uplifted eastern area and squeezed salt walls and anticlines outlining the NW-SE crustal compressional stress direction. In the North-Balearic basin, the regional thickness changes in the brittle layer are related to the distributary channel-levees system of the Rhone deep-sea fan whereas local variations are directly associated with the salt-related deformation (segmentation in ridges and minibasins). In the Algerian basin, the lateral thickness changes correspond, in the west, to the segmentation in ridges and minibasins whereas, in the east, tectonic uplift has created a wedge-shaped basin, where strata thicken upslope. In both cases, the influence of the crustal tectonics on salt tectonics is strong whether this influence is active or passive. Conversely, studying the geometry and distribution of the salt structures and the relationship between the depth of the top salt and the brittle cover thickness appears to be a very good way to distinguish between deformation caused by salt tectonics alone and deformation directly controlled by neotectonics or by inherited structures.